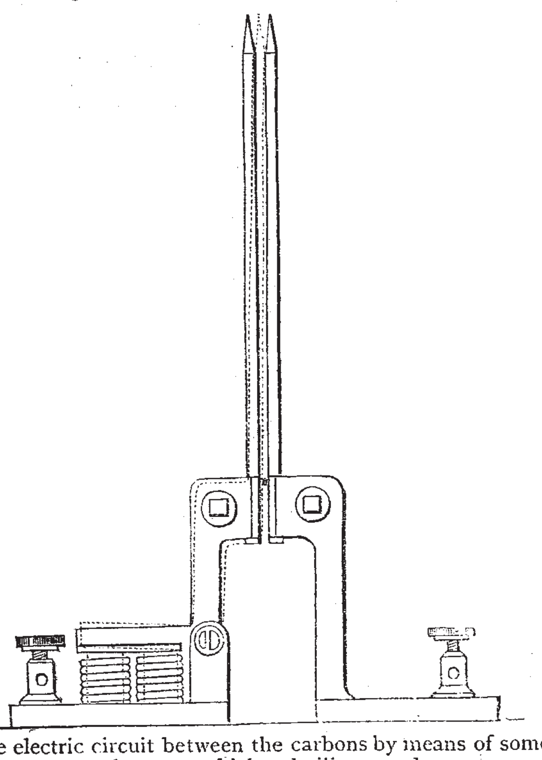
the 12th inst., an additional sum of 250*l.* was voted for their prosecution, and that they will be actively resumed as soon as Dr. Greenfield has completed his arrangements.

The interval of inactivity has been used by the committee for carrying out important improvements of the premises in Wandsworth Road, so that Dr. Greenfield will enter on his new duties with many advantages in his favour—an excellent laboratory, sufficient resources, fruitful work already in progress, and a committee including such men as Busk, Gull, Paget, Quain, Sharpey, and Simon to back him. We feel confident that the wisdom of the appointment will be justified by the result, and that the new chapter in the history of the Brown Institution which will begin with the year 1879, will be a successful one.

ON SOME IMPROVED METHODS OF PRODUCING AND REGULATING ELECTRIC LIGHT[1]

In a former communication to the Society I directed attention to the fact that when the electric light is produced from the ends of two carbon pencils placed parallel to each other, if the strength of the electric current, the thickness of the carbons, and the distance between them are rightly proportioned, the carbons will burn steadily downwards until they are wholly consumed, without any insulating material between them. To initiate the light by this method, it is necessary to complete



the electric circuit between the carbons by means of some conducting substance, which volatilises on the passage of the current, and establishes the electric arc between the points.

When a number of such lights are produced simultaneously from the same source of electricity, any interruption in the continuity of the current extinguishes all the lights in the same circuit, and each pair of carbons requires to be reprimed before the lights can again be established. This defect, as will be obvious, would cause great inconvenience when the lights are not easily accessible, or are at considerable distances apart.

In the course of my experiments it was observed that when the electric circuit was completed at the bottom of a pair of carbons close to the holders, the arc immediately ascended to the points, where it remained so long as the current was transmitted. My first impression of this peculiar action of the arc was, that it was due to the ascending current of hot air by which it was surrounded. This, however, was found not to be the cause, as the arc travelled towards the points in whatever position the carbons were placed, whether horizontally or vertically in an inverted position. Moreover, when a pair of carbons were held in the middle by the holders, the arc travelled upwards or downwards towards the points, according as the circuit was established above or below the holders. The action was, in fact, recognised to be the same as that which determines the propagation of an electric current through two rectilinear and parallel conductors submerged in contact with the terrestrial bed, which was described by me in the *Philosophical Magazine*, August, 1868.

In all the arrangements in general use for regulating the electric light, the carbon pencils are placed in the same straight line, and end to end. When the light is required, the ends are brought into momentary contact, and are then separated a short distance to enable the arc to form between them. The peculiar behaviour of the electric arc when the carbons are placed parallel to each other, suggested to me the means of lighting the carbons automatically, notwithstanding the fact that they could only be made to approach each other by a motion laterally, and to come into contact at their adjacent sides. To accomplish this object, one of the carbon holders is articulated or hinged to a small base plate of cast iron, which is so constructed as to become an electro-magnet when coiled with a few turns of insulated wire. The carbon holder is made in the form of a right-angled lever, to the short horizontal limb of which is fixed an armature placed over the poles of the electro-magnet. When the movable and fixed carbon holders are brought into juxtaposition, and the carbons inserted in them, the upper parts of the two carbons are always in contact when no current is transmitted through them, as shown by the dotted lines in the engraving.

The contact between the carbons is maintained by means of an antagonistic spring inserted in a recess in one of the poles of the electro-magnet, and reacting on the under side of the armature. One extremity of the coil of the electro-magnet is in metallic connection with the base of the carbon holder, while the other extremity of the coil is in connection with the terminal screw at the base of the instrument from which it is insulated. The coils of the electro-magnet are thus placed in the same circuit as the carbon pencils.

When the alternating current from an electro-magnetic induction machine is transmitted through the carbons, the electro-magnet attracts the armature and separates the upper ends of the carbons, which brings them into their normal position, and the light is immediately produced. When the circuit is interrupted, the armature is released; the upper ends of the carbons come into contact, and the light is produced as before. When several pairs of carbons are placed in the same circuit, they are, by this arrangement, lighted simultaneously.

H. WILDE

INFLUENCE OF THE STRAITS OF DOVER ON THE TIDES OF THE BRITISH CHANNEL AND THE NORTH SEA[1]

THE conclusions are :—

1. The rise and fall of the water-surface and the tidal streams throughout the North Sea north of the

[1] Supplement to Paper read at the Manchester Literary and Philosophical Society, November 26 (see NATURE, vol. xix. p. 78). Communicated by the Author.

[1] Abstract of a paper read at the Dublin meeting of the British Association.

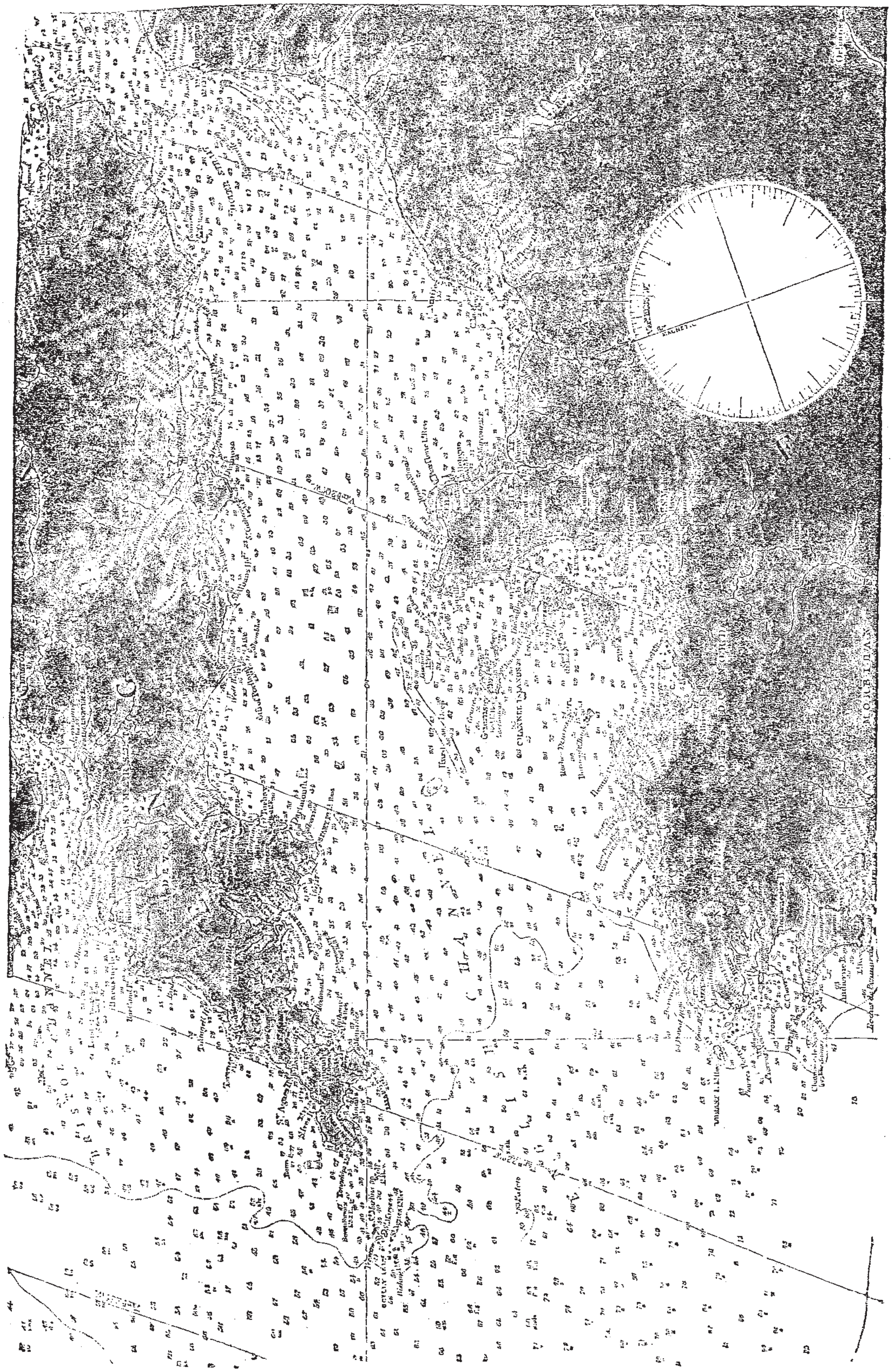


CHART OF THE ENGLISH CHANNEL.

parallel of 53° (through Cromer, in Norfolk) and the north coast of Holland and Hanover, are not sensibly different from what they would be if the passage through the Straits of Dover were stopped by a barrier.

2. The main features of the tides (rise and fall and tidal streams) throughout the British Channel west of Beachy Head and St. Valery-en-Caux do not differ much from what they would be if the passage through the Straits were stopped by a barrier between Dover and Cape Grisnez (Calais).

3. A partial effect of the actual current through the Straits is to make the tides throughout the Channel west of a line from Hastings to the mouth of the Somme more nearly agree with what they would be were there a barrier along this line than what they would be if there were a barrier between Dover and Cape Grisnez.

4. The chief obviously noticeable effect of the openness of the Straits of Dover on tides west of Beachy Head is that the rise and fall on the coast between Christchurch and Portland is not much smaller than it is.

5. The fact that the tidal currents to the westward commence generally an hour or two before Dover high-water and to the eastward an hour or two before Dover low-water instead of exactly at the times of Dover high- and low-water, is also partially due to the openness of the Straits of Dover.

6. The facts referred to in Nos. 4 and 5 are wholly due to three causes:—

(1) The openness of the Straits of Dover.

(2) Fluid friction (in eddies along the bottom and in tide-races).

(3) Want of absolute simultaneity in the time of high-water across the mouth of the Channel from Land's End to Ushant.

It is certain that (1) is very sensibly influential; it is probable that (2) is also so; it is possible, but scarcely probable, that (3) is so. Without farther investigation it would be in vain to attempt to estimate the proportionate contributions of the three causes to the whole effect.

7. It is certain that were the Straits of Dover barred, and were the water frictionless, there would be nearly a perfect *nodal line* [with but a small deviation from perfect nodality because of the influence of cause (3)] across the Channel from somewhere near St. Alban's Head on the English coast to somewhere near Cape La Hague or Cherbourg or Cape Barfleur, on the French coast, that west of this line the time of low-water, and east of this line the time of high-water, would be exactly the same as the time of high-water at Dover; and that throughout the Channel the water would be flowing eastwards while the tide is rising at Dover, and westwards while the tide is falling at Dover.

8. (Understanding from Fourier's elementary principles of harmonic analysis that all deviations from regular simple harmonic rise and fall of the tide within twelve hours are to be represented by the superposition of simple harmonic oscillations in six-hours period, and four-hours period, and three-hours period, and so on—like the "overtones" which give the peculiar characters to different musical sounds of the same pitch.) The six-hourly oscillation which gives the double low-water at Portland and the protracted duration of the high-water at Havre[1] is probably in part due to the complex-harmonic character of the current through the Straits of Dover; that is to say, definitely, to a six-hourly periodic term in the Fourier-series representing the quantity of water passing through the Straits per unit of time, at any instant of the twelve hours.

The double high-water experienced at Southampton, and in the Solent, and at Christchurch and Poole, and still further west, generally attributed to the doubleness of the influence experienced from the tidal streams on the two sides of the Isle of Wight, seems to have a continuity of cause with the double low-water at Portland, which is certainly allied to the protracted high-water of Havre—a phenomenon quite beyond reach of the Solent's influence. It is probable, therefore, that the double high-water in the Solent and at Christchurch and Poole is influenced sensibly by the current through the Straits of Dover, even though the common explanation attributing them to the Isle of Wight be in the main correct.

WILLIAM THOMSON

[1] At Havre, on the French coast, the high-water remains stationary for one hour, with a rise and fall of three or four inches for another hour, and only rises and falls thirteen inches for the space of three hours; this long period of nearly slack water is very valuable to the traffic of the port, and allows from fifteen to sixteen vessels to enter or leave the docks on the same tide.

OUR ASTRONOMICAL COLUMN

OCCULTATIONS OF STARS BY JUPITER'S SATELLITES. —Mr. Tebbutt, of Windsor, N.S.W., writes to the *Astronomische Nachrichten*, that on October 5 he made "an observation, which, if not without a parallel in the annals of astronomy, is at least an extremely rare one." A star of the ninth magnitude was occulted by the first satellite of Jupiter, under sufficiently good definition to allow of the latter being seen with a round disk: the occultation was not quite central, the star appearing to pass behind the northern portion of the disk. From the approximate position assigned to the star by Mr. Tebbutt, it must have been No. 20236 of Oeltzen's Argelander, called 9·10 mag.

The observation is not quite without a parallel, though doubtless a rare one; Flaugergues of Viviers (who, by the way, was the first discoverer of the great comet of 1811, as Mr. Tebbutt was also discoverer of the grand comet of 1861) observed an occultation of a small star by the third satellite of Jupiter on the morning of August 14, 1821, as described in a letter to Baron de Zach, which will be found in his *Correspondance Astronomique*, vol. v. p. 456. Flaugergues had proceeded to his observatory to watch an eclipse of the satellite, and on looking at Jupiter he remarked a small star near it; the satellite approached the star, and at 1h. 47m. sidereal time, appeared to touch it; at 1h. 56m. 52s. the star was no longer visible; at 1h. 59m. 10s. the satellite in its turn vanished in the shadow of the planet. He continued at the telescope some time after its disappearance, hoping to witness the star's emergence, but twilight soon became too strong. Perhaps now that the phenomena of Jupiter's satellites are more closely watched than formerly, such observations may become somewhat less exceptional; Mr. Tebbutt is doing good service in the observation of the phenomena of the Jovian system, as is also another Australian observer, Mr. Todd, at Adelaide.

OCCULTATION OF 64 AQUARII BY THE PLANET JUPITER.—It appears certain that the star 64 Aquarii, generally rated $6\frac{1}{2}$ magnitude, will be occulted by the planet Jupiter on September 14, 1879. The apparent place of the star for that day, taking its mean place from the Greenwich catalogue of 1864, with Mädler's proper motion, will be in R.A. 22h. 32m. 58·45s., N.P.D. 100° 39′ 0″·6, whence, with the position of Jupiter from Leverrier's tables, as given in the *Nautical Almanac*, the apparent conjunction will take place at 1h. 53m. Greenwich mean time, when the geocentric difference of declination is 9″·8. The polar semi-diameter of the planet is 23″·0 and its horizontal parallax 2″·2. It is clear, therefore, that there must be an occultation. The phenomenon will be most favourably witnessed at the Australian observatories; at Melbourne, for instance, the planet will be only a quarter of an hour from the meridian and 27° from the zenith.

THE CONJUNCTION OF MARS AND SATURN, JUNE 30, 1879.—The *Nautical Almanac* notifies a conjunction of these planets on June 30, 1879, at 8h. G.M.T., with Mars only 1′ to the north of Saturn. It is not without interest